

Application Serial No. 10/536,593
Reply to office action of February 22, 2008

RECEIVED
CENTRAL FAX CENTER

APR 21 2008

PATENT
Docket: CU-4233

Amendments To The Claims

The listing of claims presented below will replace all prior versions, and listings, of claims in the application.

Listing of claims:

1-24. (cancelled)

25. (original) In a method for synchronizing downlink signals of a mobile communication system, and searching cells wherein a frame of the downlink signal comprises: a first slot which includes a first preamble having a first symbol with a valid symbol length and a second symbol corresponding to part of the first symbol with a phase rotated by 180° , and a second preamble which has a pattern specific to each cell for cell search; and a plurality of second slots which have a plurality of pilot symbols provided on the time axis and the frequency axis, a method for synchronizing downlink signals and searching cells, comprising:

(a) estimating a point at which correlation of a cyclic prefix of the downlink signal and a valid symbol becomes the maximum as a symbol timing, and estimating initial symbol synchronization;

(b) using a characteristic that the real number part of the autocorrelation of the estimated initial symbol synchronization and the first and second symbols has a negative sign, and estimating frame synchronization;

(c) using the estimated frame synchronization and the first and second preambles, and estimating time and frequency synchronization; and

(d) using the second preamble and searching the cells when the time and

Application Serial No. 10/536,593
Reply to office action of February 22, 2008

PATENT
Docket: CU-4233

frequency are synchronized through the synchronization step of (c).

26. (original) The method of claim 25, wherein the step of (c) comprises:

detecting a phase of a moving average of a signal obtained by delaying the downlink signal by a repeated time difference and the downlink signal, and estimating a frequency offset;

estimating a point for maximizing the correlation result of the pattern of the first preamble and the downlink signal, and estimating fine symbol synchronization; and
using the second preamble, and estimating fine frequency synchronization.

27. (original) The method of claim 25, wherein a pilot pattern of the pilot symbol in the second slot includes a first pattern in common for each cell, and a second pattern different for each cell, and

the step of (b) comprises:

using the estimated symbol synchronization and the first pattern, and estimating slot synchronization; and

using a characteristic that the real number part of the autocorrelation of the estimated slot synchronization and the first and second symbols has a negative sign, and estimating frame synchronization.

28. (previously presented) The method of claim 27, wherein the pilot symbols in the second slot are provided on the time axis and the frequency axis for each of a plurality of transmit antennas, and

Application Serial No. 10/536,593
Reply to office action of February 22, 2008

PATENT
Docket: CU-4233

the step of estimating the slot synchronization comprises:
using the estimated initial symbol synchronization, and estimating a signal power for each transmit antenna;
comparing the estimated signal powers of the respective antennas with a predefined reference value; and
selecting or combining the first pattern of the transmit antenna having a power greater than the reference value, and estimating slot synchronization.

29. (original) In a method for synchronizing and searching adjacent cells from downlink signals of a mobile communication system wherein a frame of the downlink signal comprises: a first slot which includes a first preamble having a first symbol with a valid symbol length and a second symbol corresponding to part of the first symbol with a phase rotated by 180° , and a second preamble which has a pattern specific to each cell for cell search; and a plurality of second slots which have a plurality of pilot symbols provided on the time axis and the frequency axis, a method for synchronizing adjacent cells and searching cells, comprising:

(a) calculating autocorrelation of a cyclic prefix of the downlink signal and a valid symbol;

(b) excluding a result which corresponds to a symbol start position of the current cell from a result of the autocorrelation, estimating a point for maximizing the autocorrelation, and estimating initial symbol synchronization of adjacent cells;

(c) using the estimated initial symbol synchronization of the adjacent cell, and estimating autocorrelation of the first preamble;

Application Serial No. 10/536,593
Reply to office action of February 22, 2008

PATENT
Docket: CU-4233

(d) excluding a result which corresponds to a frame start position of the current cell from a result of the autocorrelation estimated in (c), estimating a point for maximizing the result of the autocorrelation, and estimating frame synchronization of adjacent cells;

(e) using the estimated frame synchronization of the adjacent cells and the first and second preambles, and estimating time and frequency synchronization of the adjacent cells; and

(f) using the second preamble to search the cells, and excluding a result which corresponds to the current cell from the cell search result to search the cells.

30. (original) The method of claim 29, wherein the step of (e) comprises:
using the first preamble, and estimating a frequency offset;
using the first preamble, and estimating symbol synchronization correlation;
excluding a result which corresponds to a symbol start position of the current cell from the symbol synchronization correlation result, estimating a point for maximizing the correlation result, and estimating fine symbol synchronization of the adjacent cell; and
using the second preamble, and estimating fine frequency synchronization.

31. (original) The method of claim 29, wherein the step of (f) comprises: further using a specific pattern for each cell of the pilot symbol, and searching the cells.

32. (original) In a method for synchronizing and searching adjacent cells from downlink signals of a mobile communication system wherein a frame of the downlink

Application Serial No. 10/536,593
Reply to office action of February 22, 2008

PATENT
Docket: CU-4233

signal comprises: a first slot which includes a first preamble having a first symbol with a valid symbol length and a second symbol corresponding to part of the first symbol with a phase rotated by 180° , and a second preamble which has a pattern specific to each cell for cell search; and a plurality of second slots which have a plurality of pilot symbols provided on the time axis and the frequency axis, and a pilot pattern of the pilot symbol in the second slot includes a first pattern in common for each cell and a second pattern different for each cell, a method for synchronizing adjacent cells and searching cells, comprising:

- (a) calculating autocorrelation of a cyclic prefix of the downlink signal and a valid symbol;
- (b) excluding a result which corresponds to a symbol start position of the current cell from a result of the autocorrelation, estimating a point for maximizing the autocorrelation, and estimating initial symbol synchronization of adjacent cells;
- (c) using the estimated symbol synchronization of the adjacent cell, and signal-processing the first pattern;
- (d) excluding a slot position of the current cell from the signal processed result in (c), selecting a point for maximizing the signal processed result, and estimating slot synchronization of adjacent cells;
- (e) using the estimated slot synchronization of the adjacent cells, and estimating autocorrelation of the first preamble;
- (f) excluding a result which corresponds to a frame start position of the current cell from a result of the autocorrelation estimated in (e), estimating a point for maximizing the result of the autocorrelation, and estimating frame synchronization of the

Application Serial No. 10/536,593
Reply to office action of February 22, 2008

PATENT
Docket: CU-4233

adjacent cell;

(g) using the estimated frame synchronization of the adjacent cell; and the first and second preambles, and estimating time and frequency synchronization of the adjacent cell; and

(h) using the second preamble to search the cells, excluding a result which corresponds to the current cell from the cell search result, and searching the cells.

33. (original) The method of claim 32, wherein the step of (g) comprises:
using the first preamble, and estimating a frequency offset;
using the first preamble, and estimating symbol synchronization correlation;
excluding a result which corresponds to a symbol start position of the current cell from the symbol synchronization correlation result, estimating a point for maximizing the correlation result, and estimating fine symbol synchronization of the adjacent cell; and
using the second preamble, and estimating fine frequency synchronization.

34. (original) The method of claim 32, wherein the step of (h) comprises: further using a specific pattern for each cell of the pilot symbol, and searching the cells.

35. (currently amended) In a method for configuring downlink signals in a mobile communication system, a method for configuring downlink signals, comprising:

(a) generating a first preamble which includes a first symbol and a second symbol with the phase difference of 180° with respect to the first symbol;

(b) generating a second preamble having a specific pattern for each cell of a

Application Serial No. 10/536,593
Reply to office action of February 22, 2008

PATENT
Docket: CU-4233

plurality of cells;

(c) generating the first and second preambles as a first slot; and

(d) arranging a plurality of pilot symbols on the time axis and the frequency axis,

and generating a second slot having the pilot symbols,

wherein the first symbol is a symbol which is repeated at intervals of a predetermined time period, and the second symbol is part of the first symbol with the phase rotated by 180° , and

wherein the first symbol has a valid symbol length which corresponds to a difference between a length of the transmit symbol and a length of a cyclic prefix, and the second symbol corresponds to the length of the cyclic prefix starting from the beginning part of the first symbol with the phase rotated by 180° .

36. (original) The method of claim 35, wherein the step of (b) comprises generating the second preamble so that another second preamble transmits no signals on a subcarrier on which one second preamble transmits signals, in at least one of symbols by which the second preamble transmits signals in the two different preambles.

37. (original) The method of claim 35, wherein the step of (b) comprises: preventing the another second preamble from transmitting signals on the subcarrier on which a second preamble transmits signals in at least symbol from among the symbols by which the second preamble transmits signals, in the two preambles belonging to different groups in a grouped cell search preamble set, and

using the same subcarrier in the same transmit symbol in the two second

Application Serial No. 10/536,593
Reply to office action of February 22, 2008

PATENT
Docket: CU-4233

preambles belonging to the same group, using a predefined receive signal processing method, and allocating a distinguishable signal pattern.

38. (original) The method of claim 35, wherein the step of (d) comprises: forming a set of pilot patterns distinguishable according to signal patterns transmitted to the subcarrier of the transmit symbol for transmitting the pilot symbol, and allocating a pilot pattern specific to each cell.